**New York State
Division of Homeland Security and Emergency Services
Hazard Mitigation Section**

Archived Webinar Series

HazardMitigation@dhses.ny.gov
www.dhses.ny.gov/hazard-mitigation

Part 2: Understanding The Benefit-Cost Analysis – The BCA

NEW YORK STATE | **Homeland Security and Emergency Services**

Understanding the Benefit-Cost Analysis

- A Benefit-Cost Analysis (BCA) is the process of weighing the benefits of a particular action against its costs.

- The purpose of a BCA is to demonstrate the cost-effectiveness of a project.

- A Benefit-Cost Ratio (BCR) is equal to the total project benefits divided by the total project cost
  - BCR = (Total Project Benefits) / (Total Project Cost)
  - If the benefits outweigh the costs, (BCR > 1.0), the project is deemed cost-effective.

NEW YORK STATE | Homeland Security and Emergency Services

Understanding the Benefit-Cost Analysis

- The BCA compares the conditions before and after the mitigation activity is implemented.

- This tool is utilized to calculate risk reduction in terms of losses avoided. Risk is the severity of the event and its likelihood.

- Losses are calculated based on the size (recurrence interval or frequency of the event) and are determined based on:

  – Historical costs/damages

  – Calculations from engineering analysis

  – Estimated losses

NEW YORK STATE | Homeland Security and Emergency Services

Questions To Ask Before Starting a Benefit-Cost Analysis

- What is the cost of the project?
  - In addition, how much will it cost to upkeep and maintain this project to its standard level of effectiveness?
- What natural hazard(s) is your project addressing?
- How often does this hazard occur?
- What damages is this community experiencing due to this hazard?
- How much damage will be prevented by implementing this project?

Natural Hazards – Determining Frequency

- Although we cannot predict when hazards will occur, we can estimate how likely they are based on historical events, hazard data, or specific hazard analyses (such as a Hydrologic and Hydraulic [H&H] study)

- The frequency of a hazard occurring can be represented through a Recurrence Interval (RI)

  - Example:

    - RI of a flood is 100 years

    - Probability of occurring in any one year = 1/100 = 0.01

    - Annual probability = 0.01 x 100% = 1%

NEW YORK STATE | Homeland Security and Emergency Services

Natural Hazards – Determining Damages

- What damages can be avoided by implementing this mitigation project?
  - Benefits = Future avoided costs/losses
  - Depending on the hazard, benefits can include:
    - Loss of service/function
    - Physical damages
    - Avoided injuries/loss of life
    - Emergency management costs
    - Ecosystem services benefits
    - Displacement costs

NEW YORK STATE | Homeland Security and Emergency Services

Determining Damages – Loss of Function

- Loss of Function/Service
  - Interruption to critical services, roads, bridges and utilities caused by a natural hazard event.
  - Benefits can be quantified by the value of the function and length of interruption.

Determining Damages – Loss of Function

- Critical Facilities
  - Benefits are calculated based on mitigation loss of service by allowing police stations, fire stations, hospitals, and other facilities to stay open or reduce their downtime
  - The BCA Toolkit auto calculates the value of service per day for critical facilities based on the inputs for the following questions
    - Population served by the facility
    - Distance to closest alternative facility
  - For "Other" Critical Facilities
    - An annual operating budget and duration of time (i.e., hours or days) that service was lost is required to quantify benefits.

NEW YORK STATE | Homeland Security and Emergency Services

Determining Damages – Loss of Function

- Roads/Bridges
  - Benefits are calculated depending on increased time and distance of detours needed when a road/bridge is lost/closed

- Utilities
  - Benefits are calculated based on FEMA value of service ($/person/day), multiplied by number of customers served and duration of service loss.
  - BCA toolkit uses standard values ($/person/day) for electrical, potable water, and wastewater service.

Loss of Service Type	FEMA Standard Value
Electrical	$174/person/day
Potable water	$114/person/day
Wastewater	$58/person/day

NEW YORK STATE | Homeland Security and Emergency Services

Information Needed to Start a Benefit-Cost Analysis

	Property Location	Property Structure Type	Hazard Type	Mitigation Action Type
What is it?	For each project structure: • Address • Latitude and Longitude	Description/classification of structure as: • Residential • Non-residential • Critical facility building • Utility • Road/bridge	Description of the natural hazard the project intends to address	Describes the specific mitigation project being considered, like: • Floodplain and stream restoration • Elevation / Acquisition • Infrastructure Failure
Where can you get it?	• Title documents, local building inspector, local tax assessor's office • Online mapping services (Google earth, maps etc.)	• Photos of property • Scope of work description • Design drawings • As-Builts	• Historical accounts of past damages and hazards causing them • Information from project manager, project engineer, planner, or other representative familiar with proposed project	• Scope of work description • Information from project manager, project engineer, planner, or other representative familiar with proposed project • BCA Help Menu has detailed mitigation action type descriptions

Supporting Documentation Examples

Type of Project	Examples of Supporting Documentation for Possible Benefits/Proof of Avoidable Damages
Acquisition/ Elevation/ Flood Proofing	• Cost of previous repairs/damages from flooding • Elevation Certificate • Insurance claims • Receipts for work, materials, and volunteer hours associated with repairing flood damage • Engineers' assessment of damage to building • Engineers' mitigation proposal and estimate of reduced flood water elevations in building • Services provided by facility (if it is a commercial building) • Effects of flood events on business

NEW YORK STATE | Homeland Security and Emergency Services

Supporting Documentation Examples

Type of Project	Examples of Supporting Documentation for Possible Benefits/Proof of Avoidable Damages
Drainage Improvement/ Culvert Upgrade	• Detour information for road closure due to flooding • Cost of emergency measures taken in response to flooding • Past Project Worksheets (PWs) for Public Assistance (PA) for that location • Town pay stubs/time sheets for work related to damages from past flooding • Traffic count on road for proposed mitigation project • Official town statement of materials, labor, or equipment used for work related to damages from past flooding

NEW YORK STATE | Homeland Security and Emergency Services

Supporting Documentation Examples

Type of Project	Examples of Supporting Documentation for Possible Benefits/Proof of Avoidable Damages
Generator	- Power outage history at critical facility - Cost of running an emergency shelter for one day - Emergency medical services provided by critical facility - Population served by critical facility - Distance to nearest critical facility in event power was lost

NEW YORK STATE | Homeland Security and Emergency Services

Part 3: BCA Toolkit Version 6.0 - Excel Add-In

Benefit-Cost Analysis (BCA) | Concepts

To evaluate proposed hazard mitigation projects prior to funding, FEMA requires a Benefit-Cost Analysis (BCA) to validate cost-effectiveness.

The project's total net benefits divided by its total project cost is called Benefit-Cost Ratio (BCR). If the BCR is 1.0 or greater the project is considered cost-effective.

To ensure the project is cost-effective, applicant and sub-applicant must use FEMA-approved methodologies and the Supplemental Guidance for the BCA Toolkit V6.0.

FEMA | Benefit-Cost Calculator v6.0.0

Welcome

Benefit-Cost Analysis (BCA) is the method by which the future benefits of a hazard mitigation project are determined and compared to its costs.

The end result is a Benefit-Cost Ratio (BCR), which is calculated by a project's total benefits divided by its total costs.

FEMA requires a BCA to validate cost effectiveness of proposed hazard mitigation projects prior to funding.

For a community and/or property, this tool will assist with:
- Estimating Annual Hazard Risks
- Evaluating Mitigation Cost Effectiveness
- Developing Aggregate Benefit-Cost Models

For more information, including methodologies of the calculation models used in this tool, visit FEMA BCA Website.

Getting Started

Click on the "BCA Calculator" button on the ribbon bar.
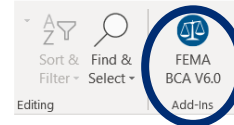
BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)
Email: bchelpline@fema.dhs.gov

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

Download the official BCA Toolkit V6.0 Excel template from:

https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis

Users will need Excel 2013 or later, or may use Excel Online Option

Benefit-Cost Analysis Toolkit

Due to Microsoft updates, users with older versions of Microsoft Windows and Excel (2013 and 2016) may experience functionality issues with the BCA Toolkit. If you are using an older version of Windows or Excel, FEMA recommends using the BCA Toolkit in Excel Online.

To help complete an analysis within the required guidelines, you must use the BCA Toolkit, which is a calculator developed using FEMA-approved methodologies and tools to show the cost-effectiveness of your projects. Do your BCA early in the project development process to make sure you will meet the cost-effectiveness eligibility requirement.

BCA Toolkit Installation Instructions

BCA Toolkit Version 6.0 ⬇

Release Notes July 2020 📄

NEW YORK STATE | Homeland Security and Emergency Services

BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)
Email: bchelpline@fema.dhs.gov

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0
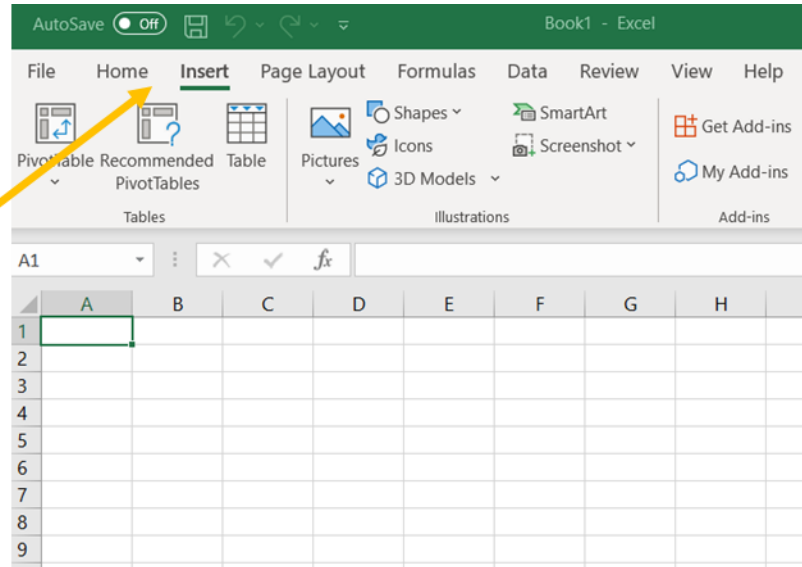
After opening Excel, the first step is to click the "Insert" tab

BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)
Email: bchelpline@fema.dhs.gov

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

After clicking the insert tab, you will have to select the "Get Add-ins" button to access the Microsoft Store.
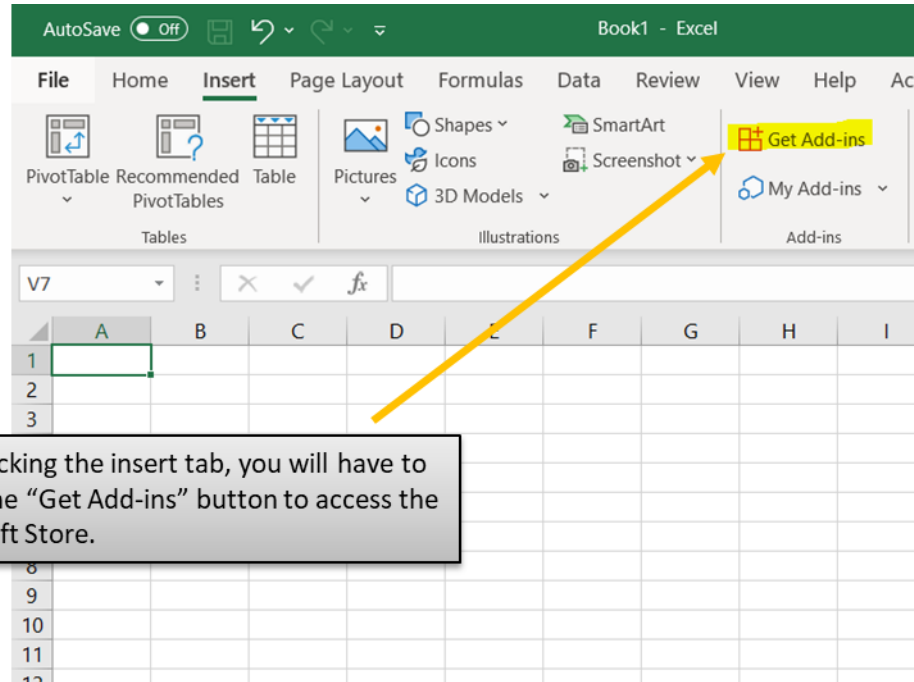
Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

Enter "BCA" into the search bar

Click "Add" next to the FEMA Benefit-Cost Analysis Calculator

BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)
Email: bchelpline@fema.dhs.gov

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0
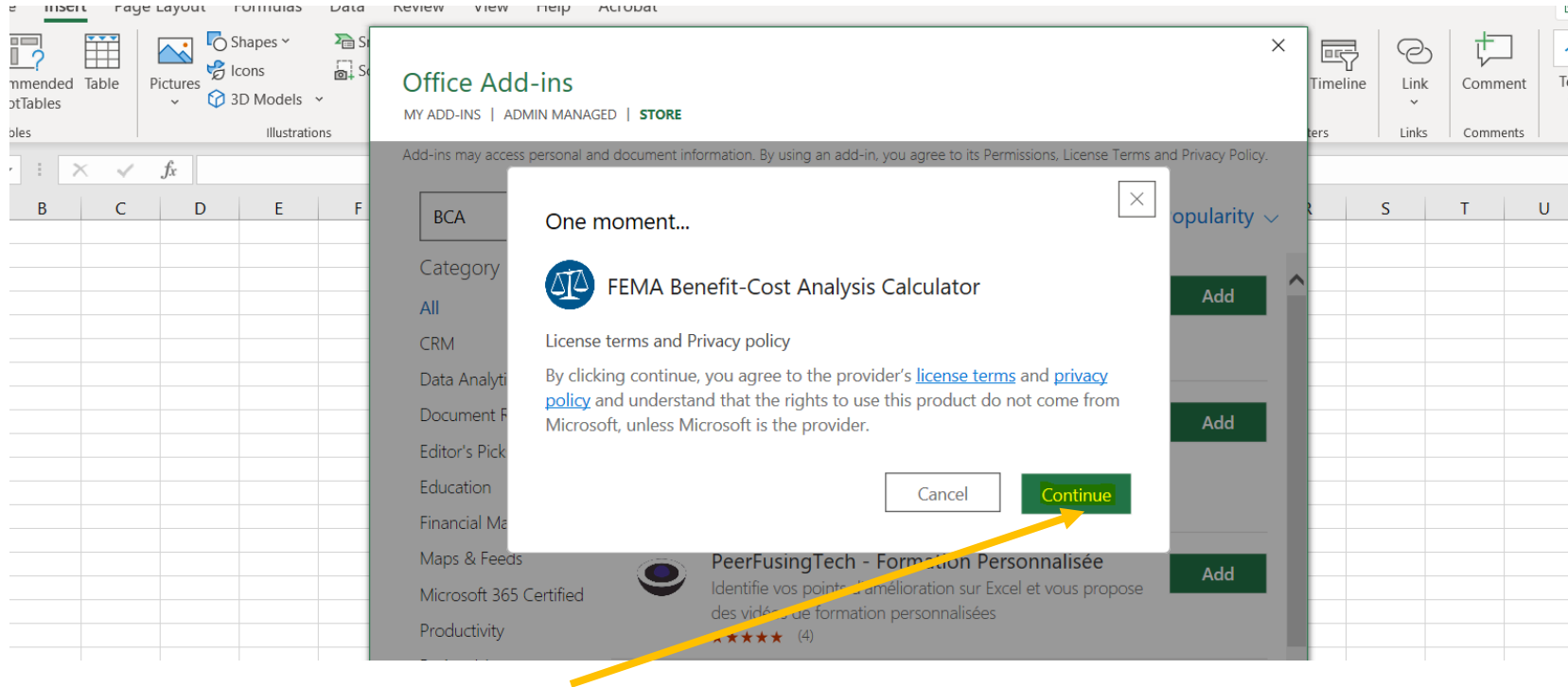
This step requires you to click the continue button.

BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)
Email: bchelpline@fema.dhs.gov

NEW YORK STATE | Homeland Security and Emergency Services

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0
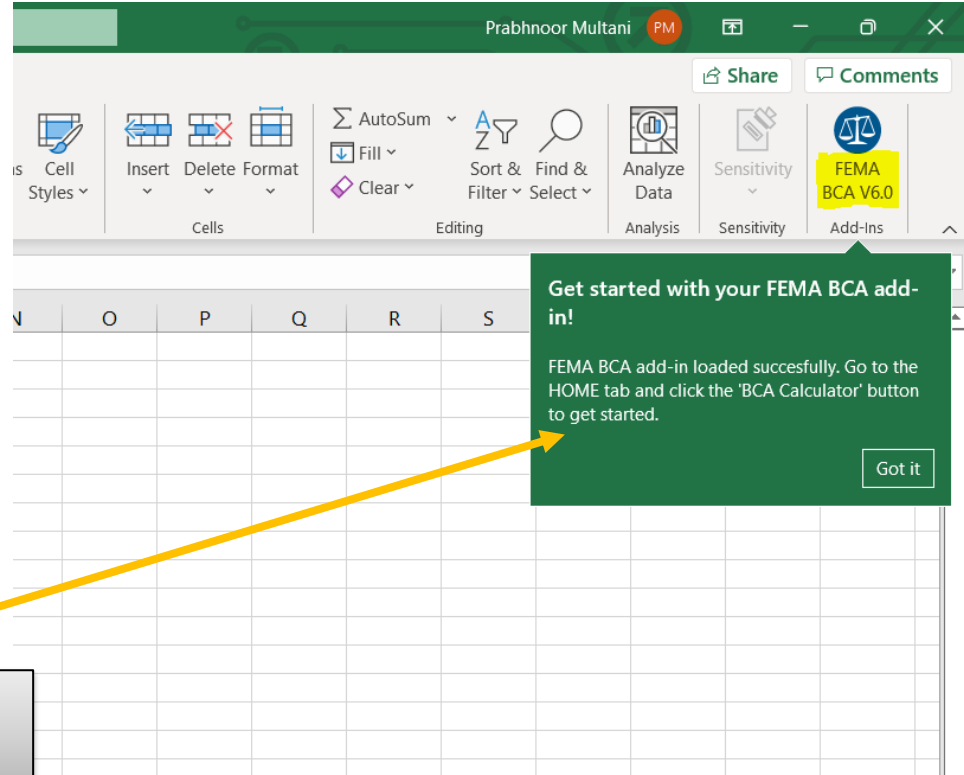
This shows you successfully added the BCA Calculator add-in to Excel

BCA Helpline: 1-855-540-6744 (9AM–5PM (EST), M-F)
Email: bchelpline@fema.dhs.gov

Part 4: BCA Toolkit Version 6.0 - Starting the Analysis

Benefit-Cost Analysis (BCA) | Start

Initial Steps

- Click FEMA BCA V6.0 Icon

- Click "Open Calculator" to begin BCA in a new window
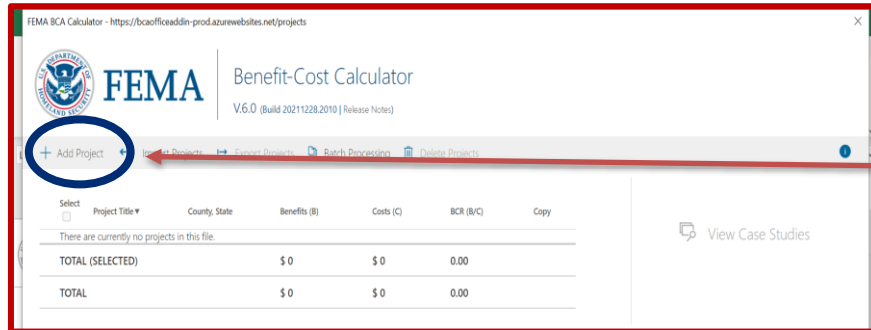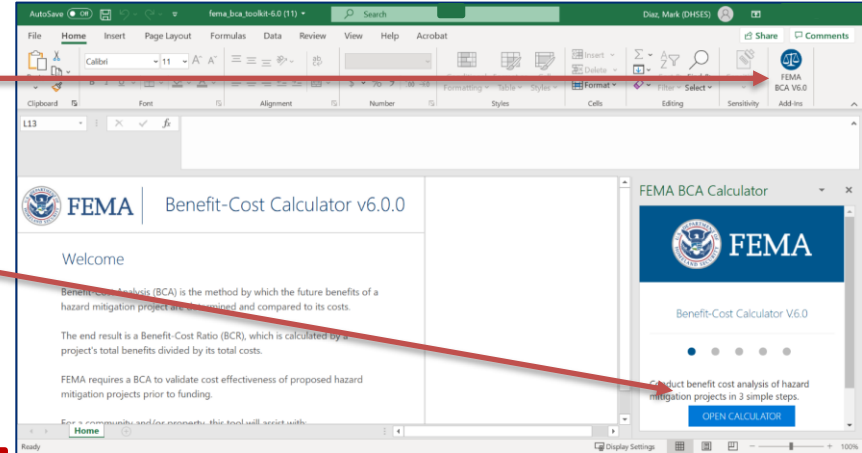
- Click "Add Project" to begin
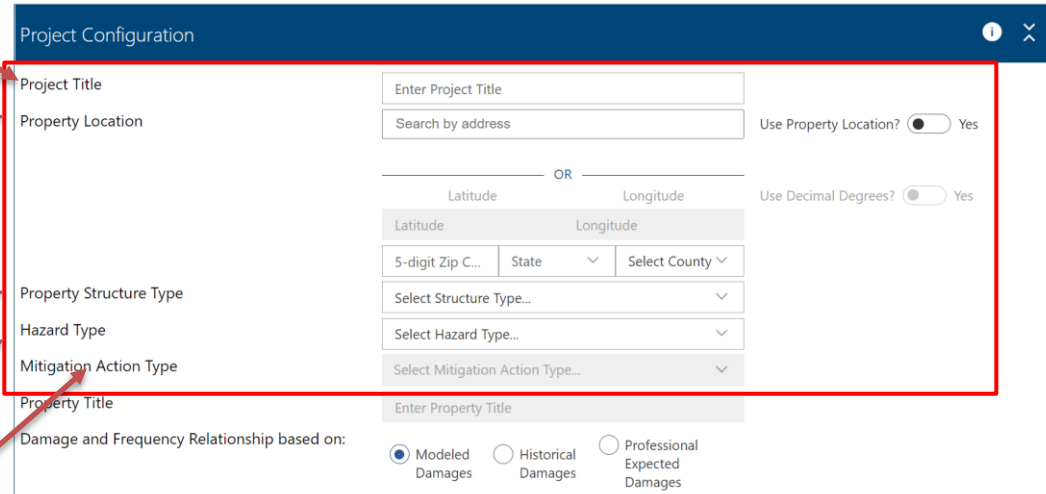
Benefit-Cost Analysis (BCA) | Project Configuration

Project Title – Input the same title as used in the sub-application for the project

Property Location- Important to use correct project address or GPS coordinates (Lat/Long)

Property Structure Type – Drop down selection (critical facility buildings, utilities, roads & bridges, residential/non-residential, and other)

Hazard Type – Drop down selection for the primary hazard being mitigated

Mitigation Action Type – Drop down selection that best relates to the proposed scope.

Benefit-Cost Analysis (BCA) | Toolkit Version 6.0

- The help button ⓘ is a great resource for standard values accepted by FEMA and defining terms used in the toolkit

- Where possible, default values have been populated in the Toolkit. Switch the toggle to "No" to enter a custom value.

- Make sure to always provide a comment and documentation if you do not use the default value provided.

Benefit-Cost Analysis (BCA) | Project Configuration - Damage and Frequency Relationship

Modeled Damages –

Select this option to perform the analysis on the property, regardless of past damage history. The BCA results for the selected hazard will be modeled based on the inputs provided.

(Note: Modeled Damages not available for generators)

Historical Damages –

Select this option: if Historic damages and losses, and the dates (years) are available.

- Sources of documents for Damages – Utility power outage report, Insurance claims, damage repair records, data from State/local agencies, newspaper citing, FEMA Project Worksheets (PW)

Damage and Frequency Relationship based on: ⦿ Modeled Damages ◯ Historical Damages ◯ Professional Expected Damages

Professional Expected Damages –

Select this option: if the scientific data would show how much damage would result, if a given event were to occur.

- Documentation could include engineering reports, technical studies, etc.
- Documentation must be provided for all damages.

NEW YORK STATE | Homeland Security and Emergency Services

Benefit-Cost Analysis (BCA) | Damage Frequency Assessment

Damage Analysis Parameters - Damage Frequency Assessment		
Year of Analysis Conducted:	2021	
Year Property was Built:	1950	
Analysis Duration (years):	72	Use Default? ◯ Yes

- **Year of Analysis Conducted** - Typically the current calendar year.

- **Year Property was Built** - When the asset being mitigated was built. e.g., buildings, utilities, roadways and bridges, other assets.

- **Analysis Duration** - Auto-calculated from the above inputs.

NEW YORK STATE | Homeland Security and Emergency Services

Part 5: Benefit Cost Analysis (BCA) Additional Resources

Homeland Security and Emergency Services

Benefit-Cost Analysis (BCA) | Additional Resources

FEMA's 2009 BCA Reference Guide**: https://www.fema.gov/sites/default/files/2020-04/fema_bca_reference-guide.pdf

FEMA's 2011 Supplement to the BCA Reference Guide**: https://www.fema.gov/sites/default/files/2020-08/fema_bca_guide-supplement.pdf

FEMA's July 2020 BCA Toolkit 6.0 Release Notes: https://www.fema.gov/sites/default/files/2020-08/fema_bca_toolkit_release-notes-july-2020.pdf

FEMA BCA Toolkit 6.0 Installation Instructions: https://www.fema.gov/fact-sheet/fema-bca-toolkit-60-installation-instructions

** Though their content is based on use of BCA Toolkit version 5.3.0, especially the included screenshots, the general principles discussed still apply to date in BCA Toolkit version 6.0.

NEW YORK STATE | Homeland Security and Emergency Services

Benefit-Cost Analysis (BCA) | Additional Resources

FEMA's 2019 Benefit-Cost Analysis Training Materials (E/L 0276 course):
https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis/training

FEMA's BCA Landing Page, including a section on Pre-Calculated Benefit materials:
https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis

FEMA Flood Map Service Center (MSC): https://msc.fema.gov/portal/home

US Army Corps of Engineers:
https://www.mvn.usace.army.mil/Portals/56/docs/PD/Donaldsv-Gulf.pdf

NEW YORK STATE | Homeland Security and Emergency Services

Benefit-Cost Analysis (BCA) | Recurrence Interval Resources

Advanced Technology Council data for hurricane windspeed and seismic data by location: https://hazards.atcouncil.org/

National Weather Service, Precipitation Frequency Data Server: http://hdsc.nws.noaa.gov/hdsc/pfds/

NOAA National Centers for Environmental Information: Storm Events Database at https://www.ncdc.noaa.gov/stormevents

U.S. Geological Survey stream gage data at https://waterdata.usgs.gov/ny/nwis/sw can be used to extrapolate frequency information for flood events.

– See section 2.1.2 from Supplement to the BCA Reference Guide (2011).

Read more on this topic from USGS at: https://www.usgs.gov/centers/new-jersey-water-science-center/floods-recurrence-intervals-and-100-year-floods

DHSES Mitigation Technical Assistance Contact

DHSES has a Technical Assistance team available and ready to provide

- Technical assistance with application development

- Assistance with the Benefit-Cost Analysis (BCA)

- Assistance to applicants who are not familiar with the FEMA HMGP process.

Mail us: HazardMitigation@dhses.ny.gov

https://www.dhses.ny.gov/hazard-mitigation

Wrap up and Questions

NEW YORK STATE | **Homeland Security and Emergency Services**